depend from elected claim 10 and, as a result, request the Examiner's consideration of claims 17 and 18. In accordance with the requirements of 37 C.F.R. § 1.121(c)(1), Applicants provide a marked-up version of the amended claims in an attached Appendix designated "Version of Claims with Markings to Show Changes Made."

In the Final Office Action, the Examiner withdrew claim 19 from consideration, objected to claims 10 and 14 for informalities; rejected claims 10, 15, and 24 under 35 U.S.C. § 103(a) as unpatentable over Kashihara, et al. (U.S. Patent No. 5,567,964) in view of Nishioka (U.S. Patent No. 5,635,420); and rejected claims 10, 14, 15, and 24 under 35 U.S.C. § 103(a) as unpatentable over Yamamichi, et al. (U.S. Patent No. 5,943,547) in view of Nishioka. Claims 1 – 10, 15, and 17 – 30 remain pending, with claims 1 – 9, 16, and 20 – 23 withdrawn from consideration as drawn to a nonelected invention.

Regarding the Final Office Action, Item 1:

Applicants submit that the Examiner improperly withdrew amended claim 19 from further consideration in item 1 on page 2 of the Final Office Action. Applicants' amended claim 19 is readable on elected embodiment 5. The amendment made to claim 19 on January 14, 2002 reads on Figure 8B, where the exemplary embodiment which includes W plug 23 and storage node electrode 27 is covered in additional detail by the recitation added to claim 19. Therefore, Applicants submit that amended claim 19 should be reconsidered as part of embodiment 5, and request that the Examiner reinstate claim 19 for examination on the merits. Applicants respectfully remind the Examiner that he "should clearly set forth in the Office Action the reasons why the claims withdrawn from consideration are not readable on the elected invention" (M.P.E.P. § 821, 8th Ed., Aug. 2001, p. 800-61), and submit that the Examiner has not met this requirement.

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Regarding the objection to claims 10 and 14, Item 2:

Applicants have amended claim 10 to include, *inter alia*, the word "insulating" in place of "dielectric," to thereby satisfy the Examiner's requirement for correction. The objection to claim 14 has been rendered moot by the cancellation of this claim without prejudice or disclaimer of the subject matter therein. Appellants therefore deem the objection overcome.

Regarding the rejection of claims 10, 15, and 24 under 35 U.S.C. § 103(a):

Regarding the claims, Applicants respectfully traverse the rejection of claims 10, 15, and 24, as unpatentable over Kashihara in view of Nishioka, for the following reasons. Regarding the 35 U.S.C. § 103(a) rejection of claims 10, 15, and 24, Applicants respectfully disagree with the Examiner's arguments and conclusions. A *prima facie* case of obviousness has not been made, since the Examiner does not show that all the elements of Applicants' claims are met in the cited references, and does not show that there is any suggestion or motivation to modify the cited references to result in the claimed invention. "To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. ... If an independent claim is nonobvious under 35 U.S.C. § 103, then any claim depending therefrom is nonobvious." M.P.E.P. § 2143.03, 8th Ed., Aug. 2001, p. 2100-26.

Kashihara and/or Nishioka, taken alone or in combination, do not teach or suggest each and every element of Applicants' present invention as claimed. The Examiner admits that Kashihara does not disclose Applicants' claimed

> "capacitor lower electrode including a bottom portion formed on the conductive plug and a cylindrical-type wall contacting the bottom portion to surround the bottom portion, the capacitor lower electrode being constituted by a plurality of crystal grains, the crystal grains containing a metallic element," or "a grain boundary between crystal grains constituting the inner wall of the cylindrical wall of the capacitor lower electrode is substantially perpendicular to an interface between the inner wall and the capacitor insulating film, and a grain

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boundary between crystal grains constituting the bottom portion of the capacitor lower electrode is substantially perpendicular to the interface between the inner wall and the capacitor insulating film." See Office Action, p. 3 and Applicants' claim 12.

Nishioka, despite the Examiner's allegations, does not cure the deficiencies of Kashihara, since it does not teach or suggest the recitations of Applicants' present claimed invention that are not taught or suggested in Kashihara. For example, Nishioka does not disclose at least "*capacitor lower electrode including a bottom portion formed on the conductive plug and a cylindrical-type wall contacting the bottom portion to surround the bottom portion, the capacitor lower electrode being constituted by a plurality of crystal grains*, the crystal grains containing a metallic element" (Applicants' claim 10, italics added for emphasis). Instead, Figs. 1 – 19 of Nishioka clearly illustrate a Ti adhesion layer 3, Pt film 4, BST film 5 and upper Pt electrode 8. Nishioka does not teach or suggest a conductive plug, or consequently, a capacitor lower electrode including a bottom portion formed on the conductive plug and a cylindrical-type wall contacting the bottom portion to surround the bottom portion, the capacitor lower electrode being constituted by a plurality of crystal grains, in any of Figs. 1 – 19. Applicants' present invention as recited in independent claim 10 is clearly not taught or suggested by Kashihara and/or Nishioka, taken alone or in combination.

In addition, Applicants respectfully point out to the Examiner that it "is impermissible within the framework of section 103 to pick and choose from any one reference only so much of it as will support a given position, to the exclusion of other parts necessary to the full appreciation of what such reference fairly suggests to one of ordinary skill in the art." See *In re Wesslau*, 147 U.S.P.Q. 391 (C.C.P.A. 1965). See also M.P.E.P. §2141.02, p. 2100-118.

Furthermore, there is no suggestion or motivation to modify Kashihara with Nishioka to result in Applicants' claimed invention. Even if the Examiner's statements that one would find it

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obvious to "form the lower electrode of Kashihara et al. having a plurality of metallic crystal grains, such as taught by Nishioka" (Office Action, p. 3) were true, which Applicants dispute, this still does not establish that there would have been the requisite suggestion or motivation to modify Kashihara with Nishioka. "The mere fact that the prior art could be so modified would not have made the modification obvious unless the prior art suggested the desirability of the modification." See *In re Gordon et al.*, 221 USPQ 1125, 1127 (Fed. Cir. 1984).

Kashihara's "object is to obtain good anti-leakage and breakdown voltage characteristics between a lower electrode layer and an upper electrode layer forming a capacitor" (Kashihara, col. 8, ll. 53 – 56). Kashihara approaches this issue by addressing the film thickness uniformity of a capacitor insulating layer and by forming a large number of perovskite structures on the capacitor insulating layer. However, Kashihara fails to disclose anything about multi-grain electrodes. See Kashihara, col. 15, l. 51 – col. 16, l. 8. Kashihara does not teach or suggest anything about a capacitor lower electrode, as claimed by Applicants' in claim 10, and Applicants have already noted that the Examiner admitted this fact. Kashihara instead focuses on the capacitor insulating layer film thickness and perovskite crystal structures formed on the capacitor insulating film. Furthermore, Kashihara also discusses film fatigue and its reduction by use of a paraelectric film as the capacitor insulating layer *instead of a ferroelectric film*. See Kashihara, col. 21, ll. 33 – 55.

Conversely, Nishioka's object "is to provide a charge-storage capacitor *ferroelectric thin film* and fabrication method with which it is possible to obtain a yield sufficient for mass production in applications to ULSIs" (Nishioka, col. 1, ll. 48 – 52, italics added). Furthermore, as already argued, Nishioka does not teach or suggest Applicants' claimed "conductive plug formed on the semiconductor substrate," or "a capacitor lower electrode including a bottom portion formed on the conductive plug and a cylindrical-type wall contacting the bottom portion

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to surround the bottom portion, the capacitor lower electrode being constituted by a plurality of crystal grains, the crystal grains containing a metallic element" (Applicants' claim 10). This, coupled with the fact that Kashihara actually suggests the use of a paraelectric film as the capacitor insulating layer instead of a ferroelectric film, demonstrates that Kashihara and Nishioka actually teach away from each other.

Thus, Kashihara does not provide the requisite motivation for its modification. Furthermore, the teaching away noted above clearly demonstrates that there would not be any reasonable expectation of success from combining Kashihara with Nishioka to produce Applicants' claimed invention.

Furthermore, the M.P.E.P. states "[a] statement [by the Examiner] that modifications of the prior art to meet the claimed invention would have been 'well within the ordinary skill of the art at the time the invention was made' because the references relied upon teach that all aspects of the claimed invention were individually known in the art is not sufficient to establish a *prima facie* case of obviousness without some objective reason to combine the teachings of the references." M.P.E.P. § 2143.01, p. 2100-124 (citations omitted, emphasis in original). Because Applicants have already established that Kashihara and Nishioka cannot be modified to produce the present invention, Applicants submit that, according to the M.P.E.P., the Examiner's reliance on Kashihara and Nishioka fails to establish *prima facie* obviousness.

Applicants have demonstrated herein that the Examiner: (a) has not shown that all recitations of Applicants' claimed invention are taught or suggested by Kashihara and Nishioka, taken alone or in combination; (b) has not shown any requisite motivation to modify Kashihara and Nishioka; and (c) has not shown there would be any reasonable expectation of success from modifying Kashihara and Nishioka, in order to produce Applicants' claimed invention.

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Furthermore, regarding the rejection of dependent claims 15 and 24, "Examiners are reminded that a dependent claim is directed to a combination including everything recited in the base claim and what is recited in the dependent claim. It is this combination that must be compared with the prior art, exactly as if it were presented as one independent claim." M.P.E.P. § 608.01(n)(III), p. 600-77. Applicants have already demonstrated that Kashihara and Nishioka, taken alone or in combination, cannot produce Applicants' present invention. Therefore, the Examiner's reliance on Kashihara and Nishioka in the rejections of dependent claims 15 and 24, respectively, still does not render Applicants' claimed invention obvious. Accordingly, Applicants submit that the 35 U.S.C. § 103(a) rejection of claims 10, 15, and 24 is improper and should be withdrawn.

Regarding the rejection of claims 10, 14, 15, and 24 under 35 U.S.C. § 103(a):

Applicants respectfully traverse the rejection of claims 10, 14, 15, and 24 as unpatentable over Yamamichi in view of Nishioka, and respectfully disagree with the Examiner's arguments and conclusions. The rejection of claim 14 has been rendered moot by the cancellation of this claim without prejudice or disclaimer of the subject matter therein.

With respect to the remaining claims which were rejected, a *prima facie* case of obviousness has not been made, since the Examiner does not show that all the elements of Applicants' claims are met in the cited references, and does not show that there is any suggestion or motivation to modify the cited references to result in the claimed invention.

Yamamichi and/or Nishioka, taken alone or in combination, do not teach or suggest each and every element of Applicants' present invention as claimed. As with Kashihara, the Examiner also admits that Yamamichi does not disclose Applicants' claimed

> "capacitor lower electrode including a bottom portion formed on the conductive plug and a cylindrical-type wall contacting the bottom portion to surround the bottom portion, the capacitor lower electrode being constituted by a

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plurality of crystal grains, the crystal grains containing a metallic element," or "a grain boundary between crystal grains constituting the inner wall of the cylindrical wall of the capacitor lower electrode is substantially perpendicular to an interface between the inner wall and the capacitor insulating film, and a grain boundary between crystal grains constituting the bottom portion of the capacitor lower electrode is substantially perpendicular to the interface between the inner wall and the capacitor insulating film." See Office Action, p. 4 and Applicants' claim 12.

In addition, Applicants have already established that Nishioka, despite the Examiner's allegations, does not cure the deficiencies of Kashihara (which are the same deficiencies pointed out by the Examiner in relation to Yamamichi), since Nishioka does not teach or suggest the recitations of Applicants' present invention that are not taught or suggested in Kashihara. Thus, Nishioka also does not cure the deficiencies of Yamamichi, for reasons already presented.

The Examiner has therefore not met at least one of the essential criteria for establishing a *prima facie* case of obviousness, wherein "the prior art reference (or references when combined) must teach or suggest all the claim limitations." See M.P.E.P. §§ 2142, 2143, and 2143.03.

Even the combination of Yamamichi and Nishioka (if proper, which Applicants dispute) still would not produce Applicants' claimed invention. Since the combination of cited references does not teach all features of Applicants' claimed invention, there can be no suggestion or motivation in the cited references to modify Yamamichi and/or Nishioka to produce Applicants' claimed invention.

Furthermore, regarding the rejection of dependent claims 15 and 24, Applicants have already demonstrated that Yamamichi and Nishioka, taken alone or in combination, cannot produce Applicants' present invention. Therefore, the application of Yamamichi and Nishioka in the rejections of dependent claims 15 and 24, respectively, still does not render Applicants'

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claimed invention obvious. Accordingly, Applicants submit that the 35 U.S.C. § 103(a) rejection of claims 10, 15, and 24 is improper and should be withdrawn.

Regarding claims 17 and 18:

Claims 17 and 18 have been amended to directly depend from elected claim 10. Applicants submit claims 17 and 18 are patentable at least due to their dependence from claim 10.

Regarding the new claims:

Finally, Applicants have introduced new claims 25 – 30 to provide coverage for other aspects of Applicants' invention. Applicants submit that new claims 25 – 30 are supported by the originally filed application, and therefore do not constitute new matter. Applicants submit that new claim 25 contains some recitations found in claims 10, 12, and 13; new claim 26 corresponds to cancelled claim 14; new claims 27 – 29 corresponds to claims 15, 17, and 18; and new claim 30 corresponds to claim 24. Therefore, Applicants submits that new claims 25 – 30 are allowable.

Conclusion:

In view of the foregoing, Applicants submit that the rejections of claims 10, 15, and 24, as detailed and argued in the previous sections above, are improper and should be withdrawn. Applicants submit that independent claims 10, **19**, and 25 are in condition for allowance as are claims 15, 17, 18, and 24, at least by virtue of their dependence from allowable base claim 10, as are claims 26 – 30, at least by virtue of their dependence from allowable base claim 25. A favorable action is requested.

Should the Examiner continue to dispute the patentability of the claims after consideration of this Amendment, Applicants invite the Examiner to contact Applicants' representatives by telephone to discuss any remaining issues.

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Please grant any extensions of time under 37 C.F.R. § 1.136 required in entering this response. If there are any fees due under 37 C.F.R. § 1.16 or 1.17, which are not enclosed, including any fees required for an extension of time under 37 C.F.R. § 1.136, please charge such fees to our deposit account 06-0916.

Respectfully submitted,

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Dated: June 27, 2002

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APPENDIX TO AMENDMENT OF June 27, 2002

Version of Claims with Markings to Show Changes Made

AMENDMENTS TO THE CLAIMS:

Please amend claims 10, 15, 17, and 18 as follows:

10. (Twice Amended) A semiconductor device comprising:

a semiconductor substrate,

a conductive plug formed on the semiconductor substrate;

a capacitor lower electrode [formed in contact with] including a bottom portion formed on the conductive plug and a cylindrical-type wall contacting the bottom portion to surround the bottom portion, the capacitor lower electrode being constituted by a plurality of crystal grains, the crystal grains containing a metallic element;

a capacitor insulating film formed on [a side] surfaces of the bottom portion and an inner wall of the capacitor lower electrode; [and]

an insulating film formed to surround the capacitor lower electrode; and

[an] a capacitor upper electrode formed above an inner wall of the cylindrical-type wall and the bottom portion of the capacitor lower electrode via the capacitor [dielectric] insulating film,

wherein a grain boundary between [adjacent two of said plurality of] crystal grains constituting the inner wall of the cylindrical wall of the capacitor lower electrode [being] is substantially perpendicular to an interface between the [lower electrode] inner wall and the

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capacitor insulating film, and a grain boundary between crystal grains constituting the bottom portion of the capacitor lower electrode is substantially perpendicular to the interface between the inner wall and the capacitor insulating film.

15. (Amended) A semiconductor device according to claim 10, wherein a portion of the capacitor insulating film is [also] formed on a top surface of the cylindrical-type wall of the capacitor lower electrode, [the capacitor insulating film on the top surface of the capacitor lower electrode being] and is thicker than that portion of the capacitor insulating film which is formed on [the] a side of the cylindrical-type wall of the lower electrode.

17. (Amended) A semiconductor device according to claim [16] 10, wherein the lower electrode is formed of one selected from the group consisting of $SrRuO_3$, Ru, RuO_2, Re, Os, Pd, Rh, Au, Ir_x and IrO_2.

18. (Twice Amended) A semiconductor device according to claim [16] 10, wherein the capacitor insulating film is formed of one selected from the group consisting of $SrTiO_3$, (Ba, Sr)TiO_3, Ta_2O_5, and Pb(Zr, Ti)O_3.

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